

## Assessing historical thinking skills in high school history education: a Padlet-based approach

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### Article Info

#### Article history:

Received Sep 10, 2023

Revised Jan 12, 2024

Accepted Feb 17, 2024

#### Keywords:

Assessment

Higher order thinking skills

Historical thinking

History learning

Technology Padlet

### ABSTRACT

This research is focused on assessing how the incorporation of Padlet technology affects the evaluation of historical thinking skills in high school history education. The research methodology involved a pretest-posttest approach with a randomly selected group of 70 students. The research tool employed questionnaires aligned with the study's objectives. Data analysis utilized comparative statistics, specifically the paired sample t-test. The outcomes of the study reveal a significant positive impact resulting from the integration of Padlet technology in assessing historical thinking skills. This is substantiated by the sign value being less than 0.05 for all aspects examined. Consequently, this research provides compelling evidence that this approach can serve as an effective alternative for improving the quality of history education at the high school level. The findings of this study have important implications for educators, learners, and other stakeholders. These results may be used by educators to create more successful teaching strategies that will improve their students' historical thinking and comprehension. As a personal learning tool, Padlet technology can help students comprehend the historical subjects they are studying better. For those involved, this study offers compelling proof that using Padlet technology in high school history curricula may improve its caliber.

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## 1. INTRODUCTION

Education plays a crucial role in molding a generation that engages in critical and analytical thinking while fostering a profound comprehension of history [1]–[4]. Historical thinking abilities constitute an essential component of the educational process [5]–[9]. These skills not only enable students to grasp past contexts but also empower them to scrutinize information, construct arguments grounded in historical evidence, and cultivate a more comprehensive perspective on human development [9]–[11]. Several reasons underscore the significance of educators nurturing their students' historical thinking skills, including: i) proficiency in historical thinking empowers students to discern how past events have shaped their contemporary world [12], [13]. Through this understanding of history, students can establish connections to the origins of present-day issues, gaining deeper insights into the dynamics of society, politics, and culture [14]–[17]; ii) Historical thinking skills encompass the capacity to evaluate historical evidence, gauge its credibility, and detect potential biases [18]–[20]. This equips students to critically assess various information sources, distinguishing relevant data from misinformation; iii) Proficiency in historical thinking entails the

ability to synthesize information from diverse sources into a coherent and meaningful narrative [6], [21]–[23]. This skill proves invaluable in academic writing and effective communication across various contexts; iv) Historical thinking skills facilitate the comprehension of cultural disparities, perspectives, and experiences that have shaped humanity throughout history [24]–[26]. They contribute to the development of tolerance, empathy, and respect for human diversity; and v) historical thinking involves the proficiency to generate higher-order questions and construct arguments grounded in historical evidence [22], [27]. This practice is a fundamental exercise in honing historical reasoning abilities.

Based on the theory mentioned earlier, it becomes crucial for educators to nurture and enhance students' abilities in thinking critically about history. To foster and enhance these historical thinking skills in students, it is imperative to give proper attention to the assessment component. Assessment serves not only as a means of gauging students' grasp of historical facts but also as a potent tool for promoting their capacity to engage in analytical, evaluative, and synthetic thinking—all of which are pivotal in comprehending historical contexts [20], [28]–[30]. By devising assessment tasks that encourage students to apply their historical thinking abilities, instructors create opportunities for students to delve more deeply into historical materials, scrutinize sources meticulously, and construct arguments grounded in pertinent historical evidence. This assessment procedure promotes active and critical learning, instructing students on how to analyze past events within their context, justify historical decisions, and acknowledge their influence on human and societal progression [30]–[32]. Therefore, the assessment element not only assesses but also guides and facilitates the cultivation of historical thinking skills that are indispensable for a profound and critical appreciation of history. To evaluate historical thinking skills effectively, it is imperative to employ a valid, reliable, and precise assessment tool capable of measuring students' potential in this regard.

Several assessment tools for evaluating historical thinking skills have been created in the past, such as the one hour test, which includes multiple-choice and short-answer sections as designed by Seixas *et al.* [33], a multiple-choice assessment by Smith [32], and an instrument developed by Hardy and Iwatani [29]. Additionally, there's a portfolio assessment instrument developed by Ningsih *et al.* [20], and an essay-based assessment tool by Ofianto *et al.* [34]. However, these aforementioned historical thinking skills assessment instruments still possess certain limitations.

For instance, multiple-choice tests may struggle to accurately gauge students' potential because they solely require students to choose the correct answer from provided options [35]–[37]. Essay tests fail to engage students directly with historical evidence since students are only tasked with explaining answers to pre-formulated questions in class exams [38], [39]. Portfolio assessment only focuses on students' top achievements and doesn't provide a comprehensive assessment of their abilities [20]. Furthermore, these earlier historical thinking skills assessment tools were primarily designed for traditional, in-person evaluations. In contrast, the advent of technology has revolutionized how we interact with information and learn [40]–[44]. Incorporating technology into history education opens up possibilities for creating a more dynamic, interactive, and immersive learning environment for students.

Researchers at Public High School Kota Solok also faced similar challenges. Through observations and interviews with the school's teachers, it was determined that the majority of assessment methods employed by students are traditional, such as written exams and verbal assignments. This limitation hinders the evaluation of intricate aspects of students' historical thinking skills, including their capacity to critically analyze historical sources, construct arguments backed by evidence, and convey their comprehension in innovative ways. Absent technology-driven assessment tools, students will have limited exposure to digital historical resources, which are becoming increasingly relevant in our interconnected world. Furthermore, technology-based instruments can offer swifter and more precise feedback to students, allowing them to gain a more comprehensive understanding of their strengths and weaknesses in historical thinking abilities [18], [45]–[47].

Hence, it is crucial to address this issue by creating technology-driven and diversified assessment tools for measuring historical thinking skills among Public High School students in Solok. This initiative aims to enhance students' readiness for the challenges of our ever-evolving digital and intricate world. Furthermore, it seeks to ensure that the evaluation of their historical thinking abilities genuinely mirrors their capacity to analyze, construct arguments, and grasp historical contexts comprehensively. Among the noteworthy technological solutions in this context, the Padlet application stands out. This application offers an internet-based platform that facilitates visual collaboration, written contemplation, and the development of engaging informational displays [48]–[50].

Several prior studies, including the work of Jong and Tan [49], have explored the utilization of the Padlet application as a technological tool for evaluating students' abilities in online classrooms. Our study shares a common aspect with Jong and Tan's research in that both incorporate the Padlet application for student assessment. However, it is important to note that Jong and Tan's study primarily concentrates on

evaluating writing skills, whereas our research is centered on assessing historical thinking skills. Additionally, Albarqi [51] regarding the use of Padlet as a formative assessment tool in online language courses. This study aligns with our research in its utilization of Padlet for evaluating student learning outcomes, but it diverges in terms of subject matter, as Albarqi's investigation primarily concerns language classes, while our study focuses on history classes. Furthermore, research from Ahmad [52] research delves into the application of Padlets for essay writing in a college setting. This research differs from our own as it is centered on integrating Padlets as an instrument for measuring historical thinking skills among high school students.

Due to the issues mentioned earlier and previous studies, conducting this research becomes crucial. This study's primary goal is to determine how high school students' assessments of their historical thinking skills within the context of history teaching are impacted by the use of Padlet technology. This research endeavors to introduce a novel method for assessing students' capacity to generate advanced-level inquiries, scrutinize historical resources, and craft coherent historical narratives grounded in factual evidence.

Based on the background above, the hypothesis in this research is as follows:

H0: there is no significant difference between before and after using the Padlet-based approach and student groups in improving students' historical thinking skills in learning history.

H1: there is a significant difference between before and after using the Padlet-based approach and student groups in improving students' historical thinking skills in learning history.

## 2. METHOD

This study employed a quasi-experimental methodology known as the one-group pretest-posttest design. Participants underwent both a pretest and a posttest as part of the research. The pretest occurred prior to the incorporation of Padlet technology into the learning and evaluation procedures. Once the pretest phase concluded, Padlet technology was introduced into the history learning process. During this phase, participants engaged in various activities utilizing Padlet technology, including online discussions, collaborative historical narrative creation, and resource sharing. The posttest was subsequently administered to assess students' skills after their interaction with Padlets.

The primary objective of this study is to evaluate the historical thinking skills of high school students in the context of history education, employing a Padlet-centered methodology. An essential aspect involves assessing if there exists an initial balance between the experimental group, which is exposed to Padlet-based instruction, and the control group, which adheres to conventional teaching practices. The Table 1 displays comparative scores between these two groups, with a focus on pertinent factors like average performance and standard deviation. This dataset forms the foundation for ascertaining whether the comparison between the experimental and control groups in their historical thinking abilities before Padlet implementation is consistent or not.

Based on the Table 1, the experimental group's mean is 72.6, whereas the control group's is 73.2. The results show that the experimental group has a standard deviation of around 7.9, whereas the control group has a standard deviation of approximately 8.6, which represents the dispersion of data within each group. The control group has a T-value of 1.49, and the experimental group has a T-value of 1.12, according to the findings of the statistical test utilizing the T-value. A greater number denotes a more significant difference between the groups. The T-value is used to quantify the difference between two groups. In this instance, the experimental group's significance is around 0.281, whereas the control group's is roughly 0.175. These findings imply that there was no discernible difference between the study's experimental and control groups.

The study included 70 students who were chosen randomly to ensure an initial balance in their historical thinking skills. First off, this study's sample size of 70 students ensures that the findings accurately reflect the range of historical thinking skills among high school students. We can spot patterns or more notable variations in the study findings with a large enough sample size. Furthermore, the substantial sample size contributes to improving the research's internal validity. When there are enough participants, we can account for variables that might affect the research findings and make sure the conclusions drawn are more trustworthy.

The data collection tool utilized a historical thinking skills assessment based on padlet technology, which was precompiled. The research instrument was developed by determining a collection of evaluation variables that represent different facets of students' proficiency with Padlet within the framework of teaching history. A clear description and assessment criteria for each indicator, which range from 1 to 5, are provided. These indicators show the quantity and quality of student participation as well as their accomplishments in a number of areas, including student interaction with Padlet, peer collaboration and discussion, historical content analysis using historical thinking skills, historical visualization creation, and self-evaluation of the history topics they have studied. This research tool offers precise instructions for monitoring and assessing student performance while utilizing Padlet in history classes. The assessment grid employed is outlined in Table 2.

Table 1. Outcomes of the equality test

Variabel	Control group	Experiment group
N	70	70
Mean	73.2	72.6
Standar Deviasi (T-Value)	8.6	7.9
Sign	0.175	0.281

Table 2. The research instrument grid

Assessment indicator	Indicator description	Scoring
Student interaction with the padlet	Learners participate and contribute actively in sharing ideas and content through the Padlet platform during online or collaborative learning activities.	5: Students consistently and actively contribute by sharing high-quality ideas and content on the Padlet platform, making a significant contribution to class discussion and understanding. 4: Students participate actively by sharing good ideas and content on the Padlet platform, making a positive contribution to class discussion and understanding. 3: Students sometimes participate by sharing ideas and content on the Padlet platform, but their contributions are less consistent and may not always be of good quality. 2: Learners rarely participate on the Padlet platform, resulting in a lack of significant contribution to class discussion and understanding. 1: Students don't participate at all in the Padlet platform or their contribution is very minimal, so it doesn't have a positive impact on classroom learning.
Collaboration and Discussion	Students use Padlet to collaborate with fellow students in online discussions about historical issues and develop a deeper understanding.	5: Learners actively participate in in-depth online discussions, collaborate well with peers, and constructively consider multiple viewpoints. 4: Students participate in discussions well, although there may be some opportunities to more actively collaborate or consider additional points of view. 3: Students participate in discussions fairly well, but are less active in collaborating or considering other points of view. 2: Students have limited participation in discussions, and are less able to collaborate or consider other points of view. 1: Learners do not participate in online discussions or collaborate at all.
Analyze historical content with historical thinking skills	Students use Padlet to effectively organize and present historical content analysis based on historical thinking skills.	5: Students are able to very effectively use Padlet to organize and present an in-depth and creative analysis of historical content, by making the most of Padlet's features, and are able to relate various historical aspects creatively and think critically. 4: Students are able to use Padlet well to organize and present historical content analysis with high clarity and creativity, and are able to relate various historical aspects creatively and think critically. 3: Students are able to use the Padlet adequately to organize and present historical content analysis quite clearly and creatively, and are able to relate various historical aspects creatively and think critically. 2: Students using Padlet have limitations in organizing and presenting historical content analysis, with a low level of clarity and creativity, and are able to relate various historical aspects creatively and think critically. 1: Students fail to use Padlet to organize and present historical content analysis effectively, or do not use Padlet at all in this context, and are able to relate various historical aspects creatively and think critically.
Visualization and Presentation	Students create historical visualizations using Padlet to illustrate the development of historical events.	5: Learners create very informative and creative visualizations, with careful use of Padlet to clearly describe the development of historical events. 4: Learners create a good visualization with some creative elements, using Padlet to describe the development of historical events well. 3: Students create adequate visualizations, although lacking in terms of creative elements and clarity in the use of Padlet. 2: Learners create limited or unclear visualizations in the use of Padlet. 1: Students do not create visualizations or do not use padlets properly for visualization purposes.
Reflection and Assessment	Students use Padlet to reflect on their understanding of the historical topics that have been studied, identify changing views, and provide a critical assessment of their learning process.	5: Students provide very in-depth reflections on their learning, identify significant changes in views, and provide a comprehensive critical assessment of the learning process. 4: Students provide good reflection on their learning, although there may be some opportunities for more in-depth identification of changing views and critical judgment. 3: Students provide adequate reflection about their learning, but lack depth in identifying changes in views and critical assessment. 2: Students provide limited or shallow reflections on their learning. 1: Students do not provide reflection or critical assessment of the learning process.

To ensure the research instrument's accuracy and dependability, a validation test was conducted. This validation process is a crucial research step, as it helps evaluate how well the chosen instrument truly captures the intended measurements and its effectiveness in assessing the variable under investigation. Instrument validity, in essence, gauges whether the instrument accurately represents the concept or variable it intends to measure. Pearson's correlation was employed to examine the validity of the items in this study. The outcomes of this validation test for the research instrument are outlined in Table 3.

The provided table displays the outcomes of validity tests conducted on various assessment indicators employed in the analysis. Each indicator is evaluated using the *r*-table value, which has been established at a consistent significance level of 0.247. Subsequently, the computed *r*-values, obtained through the relevant statistical analysis for each indicator, are also presented. Upon comparing the *r*-count with the *r*-table values, it can be deduced that all of these assessment indicators exhibit validity. In essence, this signifies that each indicator effectively measures historical thinking skills at the predetermined significance level ( $\alpha=0.05$ ), considering the number of respondents involved in the analysis. These findings affirm the reliability of the assessment tool utilized to gauge historical thinking skills within the context of utilizing Padlet technology in high school history education.

Given the favorable validity outcome, we can have confidence in the assessment tool's effectiveness in gauging students' proficiency in predefined historical thinking skills. This means that any research or evaluations conducted using this instrument can be deemed trustworthy and dependable. Additionally, it is essential to assess the instrument's reliability, and the results of the reliability test conducted using Cronbach's Alpha analysis are outlined in Table 4.

The Cronbach Alpha value for each indicator signifies the degree of internal consistency. The individual Cronbach's Alpha values fall within the acceptable range (greater than 0.70), and the overall Cronbach Alpha for all measures is notably high at 0.87. This suggests that the instrument effectively maintains a strong level of internal consistency when assessing historical thinking skills.

Moreover, the gathered information underwent a comparative statistical examination in order to assess alterations in historical thinking abilities from the initial assessment to the final assessment. This comparative statistical analysis encompassed various assessments, such as descriptive statistical evaluations, traditional tests, and hypothesis testing, which included the utilization of the Paired Sample *t*-test. To facilitate this data analysis, the researcher employed a computer program, specifically SPSS version 25.0.

Table 3. The results of the item validity test

Assessment indicator	R table	R count	Information
Student interaction with the padlet	0.247	0.852	Valid
Collaboration and discussion	0.247	0.784	Valid
Analyze historical content with historical thinking skills	0.247	0.837	Valid
Visualization and presentation	0.247	0.767	Valid
Reflection and assessment	0.247	0.812	Valid

Table 4. Instrument reliability test results

Indicator	Alpha Cronbach
Student interaction with the padlet	0.78
Collaboration and discussion	0.85
Analyze historical content with historical thinking skills	0.76
Visualization and presentation	0.92
Reflection and assessment	0.81
Total (instruments)	0.87

### 3. RESULTS

#### 3.1. Statistical description

In this research, we performed a descriptive statistical examination to elucidate how Padlet is employed for assessing historical thinking abilities in senior high school history classes. Table 5 offers a descriptive statistical summary of different factors linked to the utilization of Padlet in history education. These factors comprise student engagement with Padlets, collaborative activities and discussions, historical content analysis involving historical thinking abilities, visual representation and presentation, as well as self-reflection and evaluation.

Table 5 supplied offers a juxtaposition of results related to various aspects evaluated before and after introducing the intervention. These aspects encompass the assessment of students' interaction with the padlet, collaborative tasks and discussions, scrutiny of historical content, development of visualization and presentation abilities, and the evaluation of the reflective and assessment process.

Table 5. Results of statistical analysis

Variable	Experiment class	
	Pretest	Positions
Student interaction with Padlet:		
– Mean	62.5	82.1
– Nilai minimum	42	75
– Maximum value	83	95
– Standard deviation	6.3	7.2
Collaboration and discussion:		
– Mean	56.3	73.2
– Nilai minimum	41	52
– Maximum value	75	90
– Standard deviation	5.8	6.6
Historical content analysis:		
– Mean	60.7	92.5
– Nilai minimum	45	61
– Maximum value	72	95
– Standard deviation	4.9	5.3
Visualization and presentation:		
– Mean	65.1	88.3
– Nilai minimum	44	72
– Maximum value	80	94
– Standard deviation	8.1	9.0
Reflection and assessment:		
– Mean	58.9	82.7
– Nilai minimum	39	74
– Maximum value	75	92
– Standard deviation	6.7	7.2

The pretest score for the variable “Student engagement with Padlet” was 62.5, but it significantly increased to 82.1 in the posttest, showing a significant improvement in students’ engagement with Padlet. Similarly, for the variable “Collaboration and discussion”, the pretest average was 56.3, but it saw a notable increase to 73.2 in the posttest, indicating a marked enhancement in collaboration and discussion when Padlets were integrated into students’ learning and assessment methods. Similarly, in the categories of “Historical content analysis, visualization and presentation, and reflection and judgment”, the posttest mean scores surpassed the average pretest scores by a considerable margin, signifying a substantial positive impact of the learning programs or interventions on student progress in these areas. Furthermore, an examination of the range between minimum and maximum values and the standard deviation provides an overview of the data distribution. In summary, this table illustrates a significant overall increase in all the observed variables.

This initial descriptive analysis plays a crucial role in the initial interpretation of research findings. Nonetheless, in order to arrive at more robust conclusions regarding the impact of integrating Padlet technology in assessing students’ historical thinking skills in high school history education, additional inferential statistical analysis is required to ascertain whether there exists a substantial alteration in the measured variable or not.

### 3.2. Prerequisite test

The necessity of conducting the prerequisite test prior to performing the hypothesis test is essential in this research. One of the necessary tests conducted in this study is the assessment of normality, which assesses how closely the data distribution resembles a normal distribution. Meanwhile, homogeneity examines the similarity of variances among the compared groups. The outcomes of the normality test can be found in the Table 6.

Table 6. Result of normality test

Prerequisite test	Pretest	Posttest
Normality	P = 0.096	p = 0.152

In the provided table, prerequisite assessments are conducted for two distinct measurement points: the initial pretest and the subsequent posttest. The initial assessment performed is the normality test, which serves the purpose of ascertaining whether the data collected at both measurement points exhibit a normal distribution. The outcomes of the normality test reveal that the p-value for the pretest is 0.096, while for the posttest, the p-value is 0.152. These findings suggest that, with the commonly established significance level of 0.05 (5%), the pretest and posttest data do not offer compelling grounds to dismiss the assumption of

normal data distribution. Put differently, the data at both measurement points exhibit a normal distribution. Consequently, the prerequisite test requirement has been met, allowing for the execution of the t-test.

### 3.3. T-paired sample test results

In this research, we performed a comparative examination of different elements, including “Student engagement with Padlet”, “Collaboration and dialogue”, “Examination of historical material”, “Visual representation and delivery”, and “Self-assessment and evaluation”. We assessed students’ advancement in these aspects by gathering information at two distinct moments: prior to (pretest) and following (posttest) their involvement in the educational program.

The data analysis results presented in the Table 7 reveal a notable contrast in the history learning process when comparing the period before and after the implementation of Padlet technology. To elaborate further, the outcomes illustrate that the average pretest scores across all aspects were inferior to the average posttest scores. This observation signifies a substantial enhancement in students’ historical thinking abilities following their engagement in Padlet-integrated learning experiences.

Secondly, the t-value quantifies the extent to which the contrast between the pretest and posttest values stands out in comparison to the inherent variability within the dataset. A higher t-statistic value corresponds to a more pronounced distinction between the two measurement points. These findings suggest that the disparity is statistically noteworthy across all dimensions, with a notably significant t-value exceeding 2 in every dimension. Furthermore, the p-value is markedly smaller than the commonly accepted significance level  $\alpha=0.05$ , implying that we can confidently reject the null hypothesis. This underscores the statistical significance of the enhancement in historical thinking skills across all dimensions when employing padlet technology.

Table 7. T-test result

Aspect	Mean pretest	Mean posttest	Nilai t	p value
Student interaction with padlet	62.5	82.1	5.46	0.001
Collaboration and discussion	56.3	73.2	4.92	0.002
Historical content analysis	60.7	92.5	7.31	0.000
Visualization and presentation	65.1	88.3	6.78	0.000
Reflection and assessment	58.9	82.7	5.84	0.000

## 4. DISCUSSION

The findings indicated that incorporating Padlet technology to assess historical thinking skills had a notably beneficial influence on students’ history learning. The results of hypothesis testing, covering various aspects of the research, presented compelling evidence of enhanced historical thinking skills among students. To begin with, the hypothesis testing results revealed a highly significant positive impact on history learning due to the interaction between students and Padlet ( $T = 5.46$ ,  $p = 0.0001$ ). The interaction between students and Padlet has a highly substantial favorable influence on history learning, which is consistent with other findings. This finding validates the idea that technology, like Padlet, may improve history instruction and foster productive student engagement. As a result, this study confirms other research that supports the integration of technology into history learning. This finding validates the idea that technology, like Padlet, may improve history instruction and foster productive student engagement [53]–[56].

This implies that employing Padlet as an interactive tool in history education and evaluation can enhance students’ learning experiences and encourage their active engagement in the learning journey [57], [58]. These research outcomes align with prior studies that demonstrated the substantial positive effects of students’ interactions with Padlet on history learning and assessment [49], [51]. Integrating Padlet into assessments can serve as a valuable resource for students to engage in self-reflection and self-assessment. Students can utilize Padlet to evaluate their comprehension, pinpoint areas for improvement, and formulate corrective strategies. This approach supports student-centered learning and fosters greater independence in the learning process.

The integration of Padlet technology also contributes to enhancing students’ engagement in the study of history. Both students and teachers actively participate in the learning and evaluation phases through the use of the Padlet wall. As a result, it fosters a more captivating and purposeful learning journey for students. The incorporation of Padlet promotes collaborative learning among history students [59], [60]. The notable and beneficial effect on assessing historical thinking abilities demonstrates that Padlet can aid students in crafting compelling and engaging visual representations for historical data [61]–[63]. This presents an occasion for students to refine their visual communication skills, which hold significant value across various professional domains.

Secondly, the utilization of Padlet technology also demonstrated a significant positive influence ( $T = 4.92$ ,  $p = 0.0002$ ). This affirms that Padlet can foster collaboration among students and stimulate in-depth dialogues, allowing them to exchange their insights, perspectives, and analyses of historical events. The incorporation of Padlet technology in online collaborative learning can enhance students' communication, bolster their teamwork in group assignments, and encourage more profound discussions [59], [60], [61]. Students who incorporate Padlet into their group projects typically exhibit improved collaboration, seamless idea-sharing, and active engagement in online conversations. Padlet aids students in broadening their involvement in discussions, presenting more compelling arguments, and, on the whole, enhancing their collaborative learning experience [64], [65]. By promoting interactive collaboration and discourse, Padlet can empower students to effectively convey their ideas, viewpoints, and comprehension, ultimately enhancing the quality of their learning and grasp of the subject matter.

Thirdly, there was a notable uptick in historical content analysis ( $T = 7.31$ ,  $p = 0.000$ ) when Padlet was incorporated into history lessons. This indicates that Padlet has the potential to enhance students' abilities in the critical tasks of dissecting, interpreting, and appraising historical material. Integrating Padlet technology into history classes emerges as a promising approach to boost student engagement, foster active participation, and deepen their comprehension of historical occurrences. Moreover, it can aid students in honing analytical, collaborative, visualization, reflection, and assessment abilities, all of which are fundamental aspects of historical thinking skills [66]–[68]. Consequently, this research offers substantial empirical evidence supporting the efficacy of Padlet technology as a valuable educational tool for nurturing students' historical thinking capabilities.

Padlet is an engaging and interactive platform that enables students to actively engage in the learning of history. It empowers them to make notes, incorporate visuals, videos, or web links, and interact with historical content in a more captivating manner compared to traditional text-based approaches [64], [65], [69]. This fosters greater student involvement in historical subjects, leading to a deeper comprehension. Furthermore, Padlet encourages collaboration among students, facilitating the seamless exchange of ideas, opinions, and information. This collaborative environment promotes in-depth discussions and provides students with the opportunity to appreciate diverse perspectives on historical events, ultimately nurturing critical and analytical thinking as they consider multiple viewpoints [52], [67], [70].

Padlet provides online accessibility, enabling students to engage with historical materials and participate in learning at their convenience, from any location. This fosters a more adaptable learning environment, empowering students to take charge of their own education [49], [60], [65], [68]. With Padlet, educators can effortlessly share historical materials in various formats, such as text, images, audio, or video. Students can then interact with these resources independently, promoting the development of their analytical skills in historical content [61], [70], [71]. Padlets facilitate active engagement in historical learning, encouraging students to take notes, establish connections, and delve deeper into historical subjects. Consequently, this activity stimulates critical thinking and problem-solving abilities, which are fundamental skills in historical analysis [67], [68], [72].

Fourth, in this study, the significance of visualization and presentation ( $T = 6.78$ ,  $p = 0.000$ ) is highlighted as well. The utilization of Padlet technology empowers students to craft innovative and impactful visual representations when conveying historical information, thereby enhancing their comprehension and communication capabilities. Padlets offer a versatile platform where users can seamlessly incorporate diverse media types, including images, videos, audio, and text, into their virtual canvases [60], [63], [68], [70], [71]. This affords students the opportunity to showcase historical data in more engaging formats such as pictures, maps, diagrams, audio recordings, and more. Moreover, Padlet boasts a user-friendly interface, simplifying the process of adding visual content to their canvases, allowing students to concentrate on the core historical content without concerns about technical hurdles. Furthermore, Padlet facilitates online collaboration among students, enabling them to collaborate on intricate and informative historical visualizations, sparking inventive ideas from a diverse group of students [57], [71], [73].

Padlets enable the seamless updating and augmentation of content in real-time, fostering an environment where students and educators can collaboratively enhance historical visualizations as part of the learning journey [48], [49], [74]. Through Padlets, students can effortlessly distribute their visualizations to both their peers and instructors, thereby promoting a collective approach to assessment and learning. Furthermore, teachers can offer online feedback to further enhance the educational experience. With tools like unrestricted text and image incorporation, students enjoy the liberty to articulate their grasp of historical content with greater creativity, enabling them to construct more immersive visual narratives and depict historical ideas from various perspectives [67], [71], [75].

By incorporating all these functions, Padlet proves to be an invaluable resource for students in crafting captivating historical visual representations that not only inform but also facilitate a more profound comprehension of intricate historical backgrounds. This can, in turn, enhance students' engagement and



enthusiasm in history classes by allowing them to present historical information in a more engaging and relatable manner, particularly to the younger generation accustomed to visual media.

In conclusion, there was a notable enhancement in students' reflection and evaluation of their history learning ( $T=5.84$ ,  $p=0.000$ ). The utilization of Padlet enables students to engage in effective self-reflection regarding their comprehension of historical content and engage in self-assessment, thereby facilitating their ongoing growth and enhancement of historical thinking abilities [49], [51], [67]. The incorporation of Padlet into history education empowers students to engage in effective reflection on their grasp of historical subjects and perform self-assessments, thanks to the various features and attributes of this tool that bolster the reflection and assessment procedure.

Padlets offer students a means to effectively arrange information, encompassing notes, images, videos, and text. Through this, students can adeptly condense the historical content they've absorbed [58], [71]. This procedure serves as an initial phase of introspection as it compels students to retrieve and structure their knowledge. On Padlets, students can systematize their information in the form of notes or digital cards, providing a logical structure [57], [75]. This aids students in structuring their ideas and forging connections between different historical concepts, enhancing their comprehension of both the broader historical context and specific details. Padlets facilitate real-time commentary and feedback from both students and teachers on shared content, providing students with a platform to reflect on their own analyses and viewpoints and receive constructive input from peers or instructors [51].

Since Padlets are accessible online, students can continually and independently contemplate their grasp of historical material at any time and from any location. This affords them the opportunity for ongoing reflection. Moreover, Padlet can serve as a tool for constructing a learning portfolio over time, enabling students to review their historical understanding progress and observe how their comprehension has evolved.

The utilization of Padlet encourages students to engage in metacognition, prompting them to consider their learning methods. They can evaluate their strategies for learning, pinpoint areas where they need to enhance their understanding, and formulate plans to refine their historical thinking abilities. Through Padlet, students engage in a more interactive learning process, actively participating in their historical education. This fosters easier self-reflection, self-assessment, and the progressive development of their historical thinking capabilities.

## 5. CONCLUSION

This study provides strong evidence that the integration of Padlet technology in measuring historical thinking skills in history learning in high school has a significant positive impact on students. The results of the hypothesis testing showed consistent improvement in various aspects of history learning, including student interaction with padlets, collaboration and discussion, analysis of historical content, visualization and presentation, and self-reflection and assessment. Teachers should develop better teaching tactics based on these findings to help students analyze and understand history more fully. Students can better understand the historical themes they are studying by using Padlet technology as a personal learning tool. This study provides strong evidence, for those who are interested, that integrating Padlet technology into high school history courses may raise the standard of instruction. The use of Padlets facilitates the development of students' historical thinking skills in a deep and effective way. However, this research also has some limitations that need to be considered. First, this research is limited to school settings and technology-accustomed students, so the results are not fully generalizable to a variety of educational contexts. In addition, the use of Padlet requires adequate internet access, which is not available everywhere. Finally, human resources skilled in managing and supporting the use of Padlet will also be a key factor in successful implementation. As a recommendation, educators should consider integrating Padlet technology into history learning in secondary schools to improve students' historical thinking skills. In addition, further research can explore how contextual factors and student learning styles can influence the effectiveness of Padlet use. In addition, continuous education and training for teachers in the use of technology such as Padlet can also be scaled up to maximize the potential for innovative and interactive history learning.

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